STATE OF SOUTH CAROLINA

BEFORE THE PUBLIC SERVICE COMMISSION

DOCKET NOS. 2019-185-E, 2019-186-E

In the Matter of South Carolina Energy Freedom Act (H.3659) Proceeding to Establish Duke Energy Carolinas, LLC's Standard Offer, Avoided Cost Methodologies, Form Contract Power Purchase Agreements, Commitment to Sell Forms, and Any Other Terms or Conditions Necessary (Includes Small Power Producers as Defined in 16 United States Code 796, as Amended) - S.C. Code Ann. Section 58-41-20(A), and South Carolina Energy Freedom Act (H.3659) Proceeding to Establish Duke Energy Progress, LLC's Standard Offer, Avoided Cost Methodologies, Form Contract Power Purchase Agreements, Commitment to Sell Forms, and Any Other Terms or Conditions Necessary (Includes Small Power Producers as Defined in 16 United States Code 796, as Amended) - S.C. Code Ann. Section 58-41-20(A)	SURREBUTTAL TESTIMONY OF BRENDAN KIRBY ON BEHALF OF SOUTH CAROLINA COASTAL CONSERVATION LEAGUE AND SOUTHERN ALLIANCE FOR CLEAN ENERGY

Q. Please state your name, position, and business address for the record.

A. Brendan Kirby, P.E., Consultant, 12011 SW Pineapple Court, Palm City, Florida, 34990.

Q. Have you previously submitted direct testimony in this docket?

A. Yes. I previously submitted direct testimony discussing Duke Energy Carolinas' ("DEC") and Duke Energy Progress' ("DEP") (together, "Duke Energy" or "the Companies") proposed Solar Integration Services Charge ("SISC") and the *DEC and DEP Ancillary*

Service Study ("*Ancillary Service Study*") conducted by Astrapé Consulting which the Companies put forth in support of the proposed SISC.

Q. What is the purpose of your testimony?

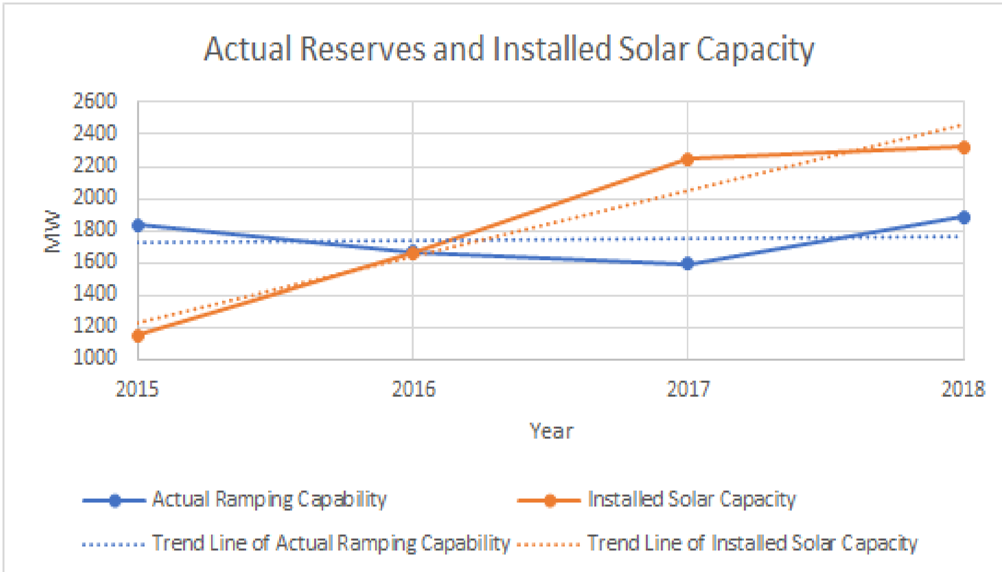
A. The purpose of my surrebuttal testimony is to respond to the rebuttal testimony of Glen A. Snider, Nick Wintermantel, and John Samuel Holeman III on behalf of Duke Energy.

I. Response to Witness Wintermantel's rebuttal testimony

Q. On page five of his rebuttal testimony, Witness Wintermantel states that "it is fair to say that each party having provided testimony in this proceeding either affirmatively recognizes or implicitly concedes that the additions of intermittent solar increases net load volatility on the DEC and DEP systems." Witness Wintermantel further states that "it is undisputed that as a result of the increase in net load volatility on the Companies' systems, the systems operate differently and in such a way that results in increased system costs." Do you agree that that these points are undisputed?

A. I do not agree with Witness Wintermantel. While it is true, as a matter of theory, that additions of intermittent solar generation may increase net load volatility, Duke Energy has failed to provide any evidence that increased solar generation on the DEC and DEP systems actually results in increased system costs. In fact, as explained in my direct testimony, Duke Energy's historical data demonstrates that the Companies' actual operating reserves (which the *Ancillary Service Study* uses to calculate the cost of integrating solar generation) <u>have not</u> significantly increased as solar capacity has increased.[1] Duke Energy's own data shows that solar capacity on the DEC and DEP systems has doubled since 2015 but operating reserves have remained largely uniform.[2]

Figure One: Historical Actual Reserves v. Installed Solar Capacity[3]



This is an important point because Duke Energy's central argument in favor of imposing a SISC is that the SISC is necessary in order to ensure that the cost of carrying increased operating reserves due to intermittent solar generation is not passed on to ratepayers.[4] But the historical data does not indicate that any significant cost exists. The Companies are asking the Commission to ignore the empirical evidence and impose the SISC on solar Qualified Facilities ("QFs") based on the predictions of a study that has not been peer reviewed or accepted by any commission in any other jurisdiction; contains myriad methodological flaws; and contradicts observed trends in operating reserves requirements in jurisdictions with high solar penetration.

[1] Direct Testimony of Brendan Kirby at pp. 8-12.
[2] *Id.* at p. 12.
[3] Source: DEC and DEP Joint Initial Statement p.7, Fig. 1; DEC and DEP Late Filed Exhibit No. 2, p. 1.
[4] Rebuttal Testimony of Glen Snider at p. 85 (quoting the Direct Testimony of ORS Witness Lawyer at pp. 5-6).

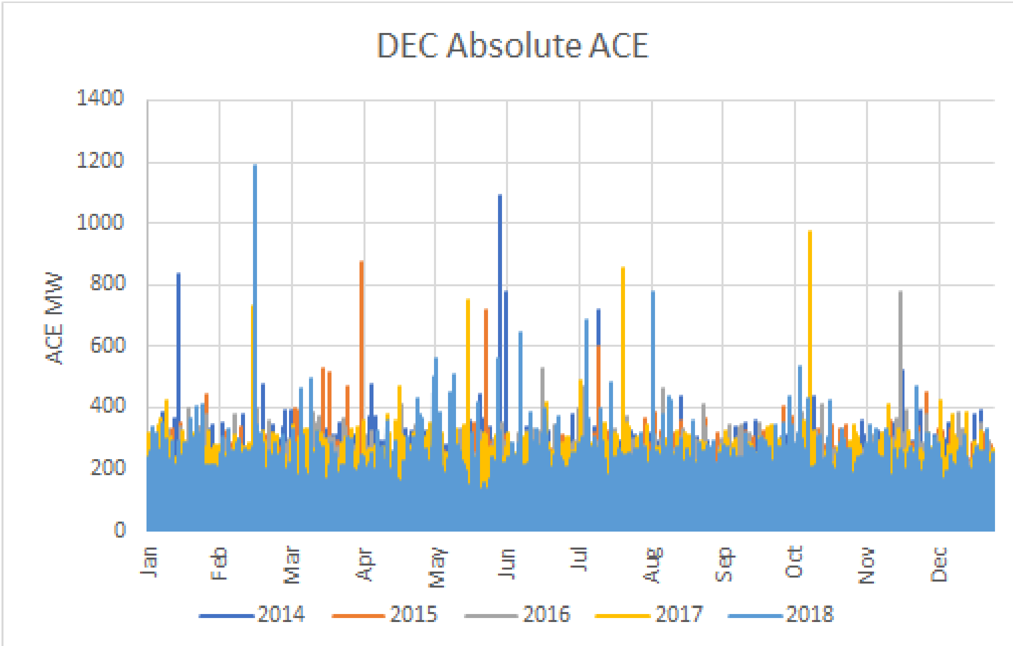
Q. Do you agree with Witness Wintermantel that "as a result of the increase in net load volatility on the Companies' systems, the systems operate differently and in such a way that results in increased system costs"?

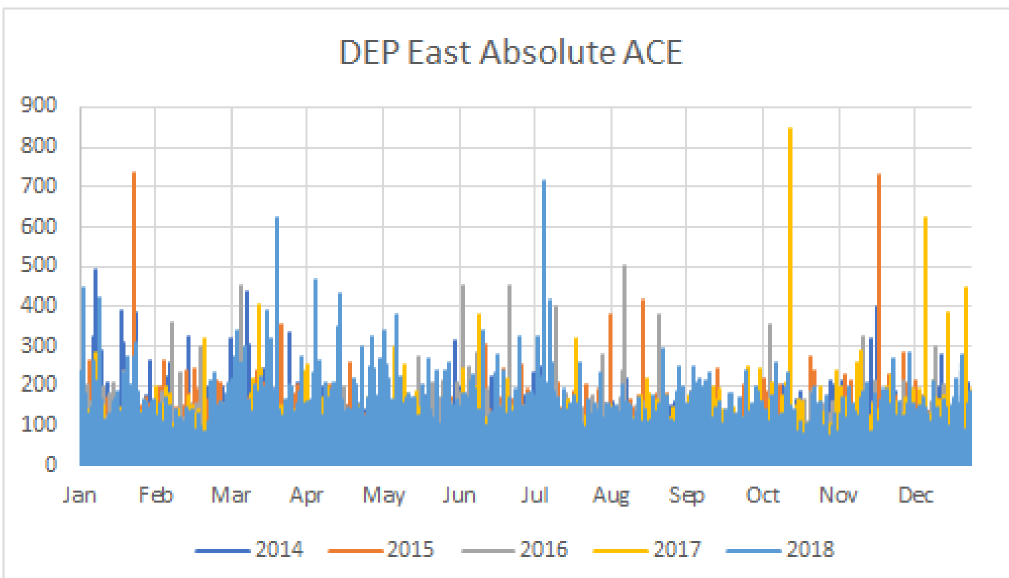
A. No, I do not. While Witness Wintermantel may be correct that "as a result of the increase in net load volatility on the Companies' systems, the systems operate differently[,]" Duke Energy has not presented any evidence that any changes in how the DEC and DEP systems operate are technically justified or result in increased costs that should be passed on to solar QFs.

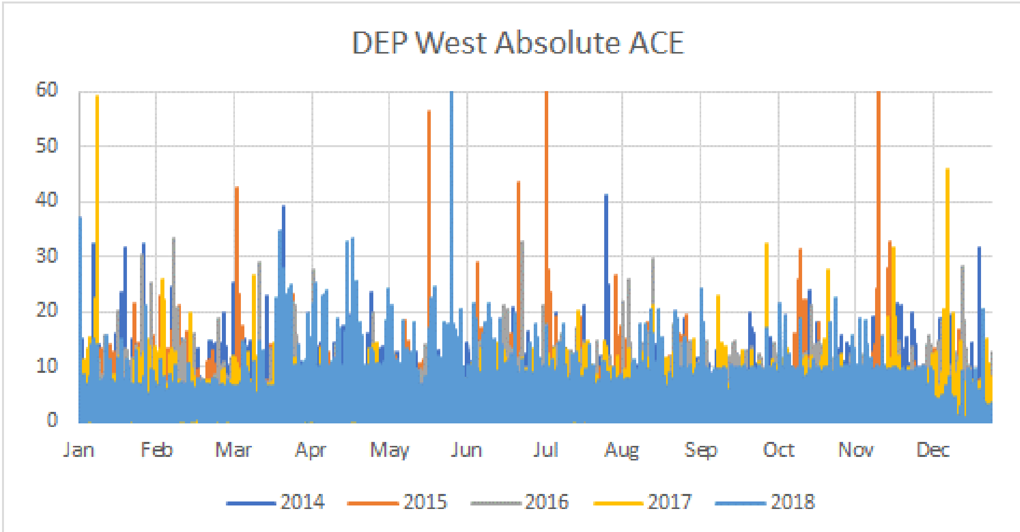
First, it is not at all clear than any changes in system operation due to increased solar volatility have been technically justified. If Duke Energy were experiencing balancing problems and did not increase operating reserves, then DEC and DEP's Area Control Error ("ACE") performance would deteriorate. We know based on the historical operating reserve data discussed above that Duke Energy's operating reserves have not increased significantly, therefore, if solar generation is creating balancing problems, DEC and DEP's ACE performance would be deteriorating. However, historical ACE data indicates that the Companies' ACE performance has remained relatively steady since 2014.[5] Furthermore, an examination of Duke Energy's historical ACE performance demonstrates that there is no annual pattern reflecting the seasonal solar pattern: if solar volatility were driving increased ACE deviations, one would expect greater and more frequent ACE deviations during seasons with greater solar variability. The data shows that no such pattern exists:

[5] Duke Energy Carolinas OASIS, http://www.oasis.oati.com/duk/: Performance metrics – FERC Order 784 ACE Data – DEC 10 min ACE 2014.xlsx, DEC 10 min ACE 2015.xlsx, DEC 10 min ACE 2016.xlsx, DEC 10 min ACE 2017.xlsx, DEC 10 min ACE 2018.xlsx; and DEC DEP Response to SACE CCL DR 2-4.

Figure Two: DEC + DEP Absolute ACE Performance







As this figure illustrates, the significant increases in solar capacity on the DEC and DEP systems between 2014 and 2018 have not translated into deteriorating ACE performance.

Second, even *if* increasing solar generation has triggered changes to DEC and DEP's system operating practices, Duke Energy is not entitled to pass costs associated with these changes onto solar QFs. In fact, different generation resources may require different operating practices, and the Companies do not, as a matter of course, penalize generators for this fact. Witness Wintermantel confirms this in his rebuttal testimony, where he argues that the Companies' 2015 operating reserve data "was an outlier due to higher coal dispatch… If coal units are left online, then it is natural to have higher operating reserves…"[6] The simple fact that the system was operated differently in order to accommodate coal units did not lead the Companies to propose a "coal integration charge." Furthermore, the Companies' transition away from coal generation has been facilitated by the availability of lower-cost renewable resources like solar energy. The

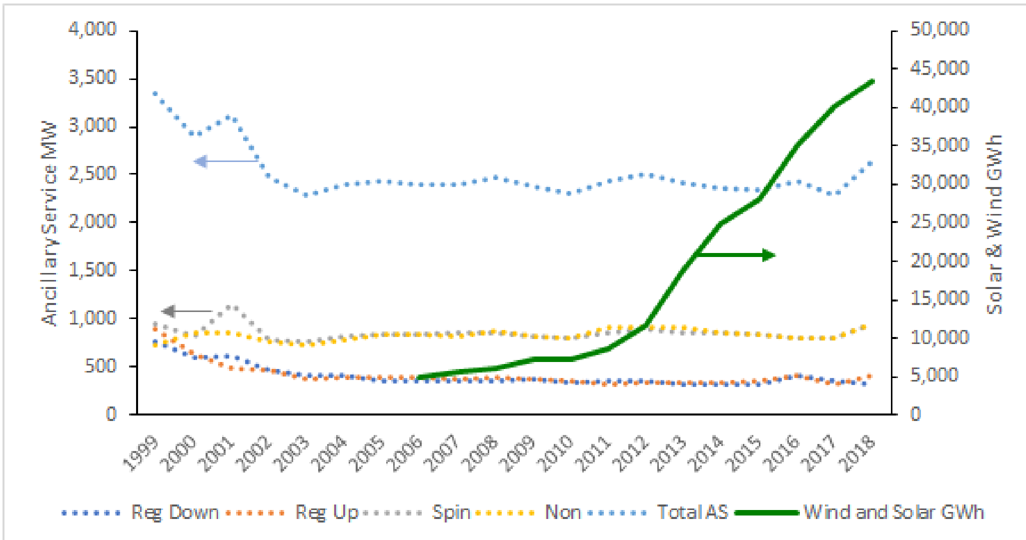
[6] Rebuttal Testimony of Nick Wintermantel at p. 26; *see id.* ("Although it would be more economic for the Companies to operate the coal resource, it may have the ancillary effect of increasing the realized reserves for that year.")

inability to cycle coal units off overnight, coupled with their relatively high minimum loads and poorer low-load efficiencies, results in higher reserve (unnecessary) availability but less efficient overnight operations than is possible with more flexible generators. It is inconsistent and discriminatory to characterize heightened reserve availability (and lower efficiency) associated with coal generation as "natural" while penalizing any increases in reserve requirements associated solar generation though the imposition of the SISC.

Q. On page 13 of your direct testimony, you state that "[o]perating reserve amounts and costs have not increased for the California Independent System Operator (CAISO) while they have integrated 20,200 MW of solar generation and 6,700 MW of wind generation." On page 23 of his rebuttal testimony, Witness Wintermantel characterizes this statement as "misleading and incorrect." Is Witness Wintermantel's characterization accurate?

A. No, it is not. In my direct testimony, I explain that CAISO's operating reserves have not increased as renewable penetration increases. My testimony is substantiated by CAISO's historical operating reserves data, reproduced here for ease of reference.

Figure Three: CAISO Operating Reserves have not increased with increasing solar and wind penetration.



In his rebuttal testimony, Witness Wintermantel cherry-picks language from CAISO's 2016 Annual Market Performance Report ("CAISO 2016 Report") stating that ancillary service costs increased from the year 2015 to 2016.[7] As you can see, in Figure Three, ancillary service cost did increase from 2015 to 2016, but almost immediately decreased when CAISO found that it did not need the additional reserves.[8] This temporary increase in regulation requirement, and the impact it had on CAISO's ancillary costs during 2016, is discussed at length in the CAISO 2016 Report that Witness Wintermantel cites in part in his Rebuttal Testimony.[9] As I explained in my direct testimony, CAISO operators learned, through actual operating experience, that they did not need to increase operating reserves in order to accommodate increased solar

[7] *See* Rebuttal Testimony of Nick Wintermantel at p. 23.
[8] California ISO, 2016 Annual Report on Market Issues and Performance at pp. 141, *available at:* http://www.caiso.com/Documents/2016AnnualReportonMarketIssuesandPerformance.pdf. ("Regulation requirements were relatively constant for many years prior to 2016. However, between February and June the ISO roughly doubled the regulation requirements to manage increased variability of renewable resources. During these months, regulation costs were about six times higher than the same months in 2015. In June, the ISO set regulation requirements back to prior levels.").
[9] *Id.* at 141-43.

generation.[10] This decrease in reserves following an initial spike is reflected in the following figures pulled directly from the CAISO 2016 Report cited by Witness Wintermantel.

Figure Four: Ancillary service cost by quarter (Figure 6.2 in CAISO 2016 Report)

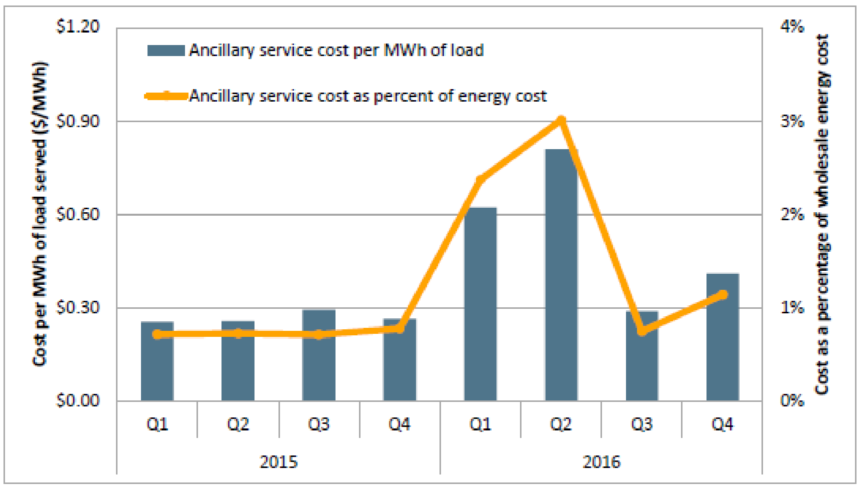
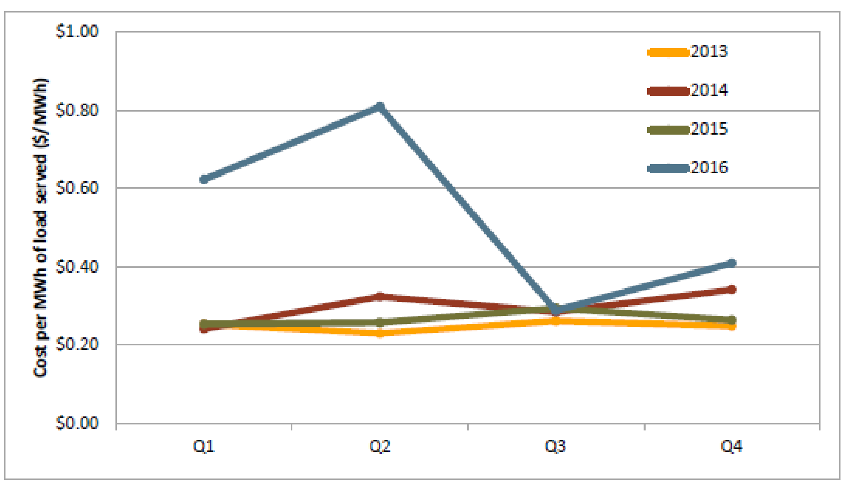


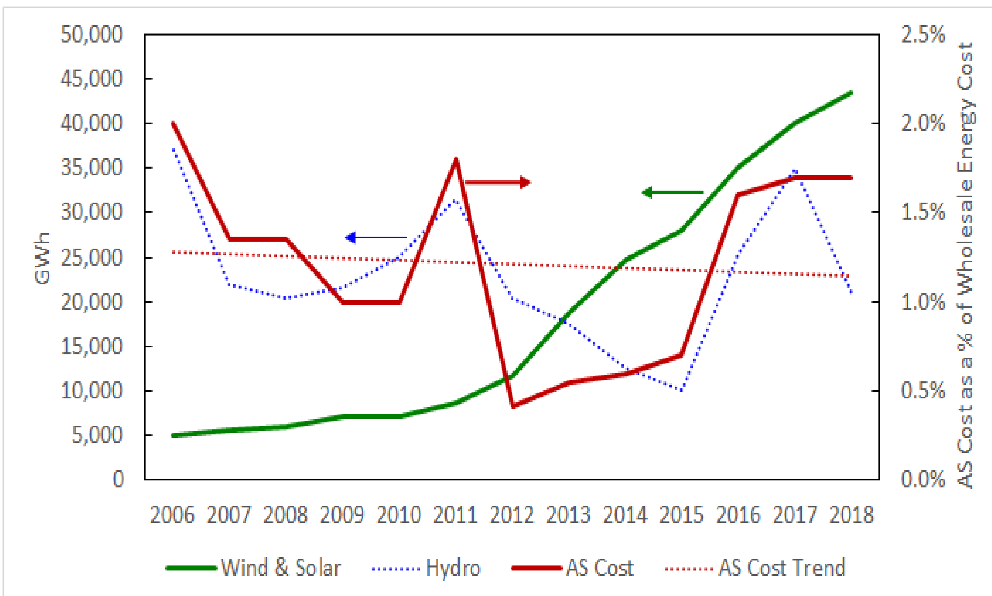
Figure Five: Ancillary service cost per MWh of load (2013-2016) (Figure 6.3 in CAISO 2016 Report)



[10] *Id.*

Furthermore, many factors affect ancillary service costs year over year, but historical reserve data demonstrates that increasing renewable generation is not correlated with increased ancillary service costs. As I explained in my direct testimony, variation in ancillary service costs correlates with hydro production, not solar and wind generation:

Figure Six: Operating reserve costs have not risen in California with increasing solar and wind penetration.



As Figure Six shows, the ancillary service cost trend as a percentage of wholesale energy cost has remained relatively steady. The spike in ancillary service costs from 2015 to 2016, which Witness Wintermantel refers to, was driven by an increase in hydro production, and levelled off after 2016 despite continued increases in renewable generation.

For these reasons, Witness Wintermantel's reliance on out-of-context language from the CAISO 2016 Report as evidence that increased renewable generation increased operating reserves in CAISO is unreasonable and should be rejected.

Q. Has CAISO issued any subsequent reports substantiating your assertion that increased renewable penetration have not increased operating reserves for CAISO?

A. Yes, it has. CAISO's 2017 Annual Report on Market Issues and Performance ("CAISO 2017 Report") explains that while CAISO operators initially increased operating reserves to accommodate increased solar generation, after just a couple months the upward adjustments were removed because they were not necessary.[11]

Furthermore, the CAISO 2017 Report explains the increase in contingency reserve requirements in 2018 (visible at the far right of Figure Three) occurred because the largest credible contingency was increased to include loss of both halves of the Pacific DC Intertie, a larger contingency than had previously been planned for.[12] Therefore the increase in CAISO's operating reserve requirements in 2018 cannot be ascribed to increased renewable generation.

Q. On page 33 of his rebuttal testimony, Witness Wintermantel states "Witness Kirby's assertion that non-spinning resources were not allowed to reduce LOLE$_{FLEX}$ is inaccurate and should be rejected. All simulations before and after solar was added allowed for non-spinning reserves or quick start resources to be turned on to prevent LOLE$_{FLEX}$ events. Therefore, his argument is flawed and should be rejected." Is Witness Wintermantel's characterization of your testimony correct?

A. No, it is not. Witness Wintermantel misunderstands my testimony. My concern with the *Ancillary Service Study's* reliance on exclusively non-spinning reserves is not related to the *Study's* deployment of resources to avert a LOLE$_{FLEX}$ event. As discussed in my direct testimony

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[11] California ISO, 2017 Annual Report on Market Issues and Performance, at p. 139, http://www.caiso.com/Documents/2017AnnualReportonMarketIssuesandPerformance.pdf
[12] *Id.* at p. 142, ("The Federal Energy Regulatory Commission approved new definitions along with BAL-002-2, effective January 1, 2018, that required the ISO to reevaluate the most severe single contingency. This change resulted in a significant increase to the operating reserve requirements after January 1, 2018, to cover the potential sudden loss of scheduling on the Pacific DC Intertie."); *see* Amended Direct Testimony of Brendan Kirby at p. 14.

and expert report, my concern is that once a $LOLE_{FLEX}$ event is identified, and the model determines that additional reserves are required in order to maintain reliability, the *Ancillary Service Study's* methodology states that only the spinning reserve requirement is increased to provide those additional reserves.[13] This requirement is inappropriate because NERC and SERC allow utilities to use non-spinning reserve to respond to contingency events. Non-spinning reserves are significantly lower cost than spinning reserves—for example, the Mid-Atlantic Dominion region of PJM, which is geographically close and similar in characteristics to DEC and DEP, publishes spinning and non-spinning reserve costs, non-spinning reserve costs were 15% of spinning reserve costs in 2018.[14] Assuming a similar relationship between the costs for non-spinning and spinning reserves in DEC and DEP—which the Companies have not contradicted—this means that allowing non-spinning reserves to provide the additional reserves the *Ancillary Service Study* calculates to be necessary could reduce the SISC by up to 85%—from $1.10/MWh to $0.17/MWh in DEC and from $2.39/MWh to $0.36/MWh in DEP.

Witness Wintermantel's testimony does highlight an important inconsistency in the *Ancillary Service Study's* methodology: if the model uses non-spin and fast-start resources to avert $LOLE_{FLEX}$ events, then why doesn't it consider cheaper non-spinning reserves as a means of maintaining reliability when it must add additional reserves?

Q. On page 34 of his rebuttal testimony Witness Wintermantel critiques your recommendation to reduce the SISC in DEC from $1.10/MWh to $0.05/MWh and in DEP from $2.39/MWh to $0.11/MWh. Witness Wintermantel states that "after reviewing [Witness Kirby's] analysis, his proposal is contrived merely based on high level estimates that contain no additional modeling of the DEC and DEP systems

[13] *Ancillary Service Study* at page 42 ("Spinning reserves and load following up reserves are identical and represent the sum of the 60-minute ramping capability of each unit on the system. To maintain operational reliability as solar resources are added, the load following up reserves are increased and compared to the Base Case level of load following…").

[14] PJM's Mid-Atlantic Dominion region data downloaded for all of 2018 from http://dataminer2.pjm.com/list.

and therefore lacks an analytical basis." Is Witness Wintermantel's characterization of your recommendations accurate?

A. No. Witness Wintermantel's characterization of my recommendations is inaccurate and incomplete. My primary recommendation is that the proposed SISC be rejected, and that the *Ancillary Service Study* methodology be modified to rectify the methodological errors I have identified.[15] I specifically recommend that any future solar integration study be subject to a Technical Review Committee composed of independent variable renewable generation integration experts who would help design and guide the analysis.[16] This is the most prudent way forward.

Witness Wintermantel's testimony refers to my recommendation that, in the event that the Commission decides to impose a SISC pending the results of a valid study, the proposed SISC should be reduced to account for the methodological flaws in the *Ancillary Service Study* that exaggerate the costs associated with solar integration.[17] The reduced SISC values that I propose are based on the *Ancillary Service Study's* results, but discounted to account for each methodological error. However, not all of the errors could be quantified—for example, the inflated reserve requirements calculated based on the inappropriate $LOLE_{FLEX}$ metric have not been accounted for. The values I propose—$0.05/MWh in DEC and $0.11/MWh in DEP—are intended as a more reasonable and moderate step pending the completion of an independently reviewed, methodologically sound integration study.

[15] Direct Testimony of Brendan Kirby at pp. 34-35.
[16] *Id.* at 35.
[17] *See id.* pp. 35-36.

Furthermore, Witness Wintermantel appears to take issue with the fact that these proposed reduced SISC values are not the product of "additional modeling of the DEC and DEP systems." As Witness Wintermantel is no doubt aware, intervenors are unable to conduct additional modeling of the DEC and DEP system without access to the relevant proprietary information and software. In at least one other jurisdiction, Astrapé and its modeling have been made accessible by the utility for input and use by stakeholders.[18] Duke Energy has not indicated any willingness to take a similar approach with intervenors to develop a more accurate methodology.

Q. In your direct testimony, you critiqued the *Ancillary Service Study* for imposing a higher reserve requirement for 8,760 hours per year instead of limiting increased reserve requirements to times and conditions when increased solar generation might cause reserve shortfalls. You explained that this uniform distribution of reserve requirements inflated ancillary service costs and therefore rendered the proposed SISC inaccurate. On pages 32-33 of his rebuttal testimony, Witness Wintermantel responded that "the *Study* did not manually increase operating reserves in 8,760 hours because many hours had already met the enhanced reserve targets" and therefore your conclusions are inaccurate. Does Witness Wintermantel's explanation resolve your concerns?

A. Witness Wintermantel's rebuttal testimony does not resolve my concerns about the *Ancillary Service Study's* imposition of higher reserve requirements 8,760 hours per year as opposed to the times and conditions when increased solar generation might cause

[18] New Mexico Public Regulation Commission Case Numbers 19-00018-UT and 19-00195-UT (relating to PNM's San Juan Coal Plant Replacement Case). PNM filings available at https://www.pnmforwardtogether.com/review-the-filing.

reserve shortfalls. I am still concerned that this uniform reserve requirement unreasonably inflates the cost of solar integration.

First, Witness Wintermantel correctly acknowledges that "it is true that commitment decisions for on-peak would also affect reserves in off-peak hours since those units would also have operating constraints[.]"[19] However, Witness Wintermantel goes on to assert, absent any supporting evidence that "in general the reserves target in off-peak hours is expected to be immaterial to the incremental commitment decisions."[20] Duke Energy has failed to provide any evidence that the *Ancillary Service Study's* requirement that reserves be uniformly increased 8,760 hours per year, even during hours when solar generation is not occurring, does not inappropriately inflate integration costs.

In fact, Witness Wintermantel's implication that the hours when solar QFs are generating represent the only times when increasing target reserves would influence commitment decisions is contradicted by the testimony of other Duke Energy witnesses. For example, Witness Snider's rebuttal testimony states that "the deployment of QF solar onto the power system does little to offset the need for future generation <u>because it does not provide a net dependable resource capable of meeting DEC's and DEP's future capacity requirements, which occur in predominantly non-daylight hours."</u>[21] If Witness Snider is correct that Duke Energy's capacity needs occur predominantly during hours when solar QFs cannot generate, then the *Ancillary Service Study's* addition of heightened reserve requirements 8,760 hours per year, including during those highest stress non-daylight hours, would increase costs significantly. The proposed SISC would then pass on those costs to solar QFs, even though a significant part of the cost is likely generated by increased reserve requirements during hours

[19] Rebuttal Testimony of Nick Wintermantel at p. 32.
[20] *Id.* at 33.
[21] Rebuttal Testimony of Glen Snider at p. 6.

when solar QFs are not generating and therefore could not possibly be imposing costs on the system.

II. Response to Witness Snider's rebuttal testimony

Q. On page 80 of his rebuttal testimony, Witness Snider states that "there is no dispute among the expert Witnesses that the integration of uncontrolled, intermittent and variable solar QFs is causing the Companies to incur increased ancillary costs." Do you agree with this statement?

A. I do not agree. As I explain above, in response to Witness Wintermantel's very similar statements, Duke Energy has not provided any evidence demonstrating that increased solar generation on the DEC and DEP systems has actually caused an increase in ancillary service costs. In fact, Duke Energy's historical operating reserve data demonstrates that actual historical operating reserves have <u>not</u> increased substantially in response to dramatic increases in solar capacity.

III. Response to Witness Holeman's rebuttal testimony

Q. In your direct testimony, you state that the *Ancillary Service Study* improperly inflates the cost of solar integration and imposes reserve requirements inappropriately because it only considers expensive spinning reserves when calculating the cost of increasing reserve requirements to maintain system reliability. You explain that allowing some or all of those increased reserves to come from non-spinning generation sources would significantly reduce the SISC because the non-spinning reserves cost less than spinning reserves. On pages 43-45 of his rebuttal testimony, Witness Holeman states that "Mr. Kirby's recommendation that the Companies rely on off-line contingency reserves to manage the integration costs

is not reasonable." Witness Holeman further states that allowing existing off-line contingency reserves to respond to solar volatility would "subject[] Duke to increasing risk of a NRC BAL-002 standard violation or requiring the operator to maintain even more on-line spinning reserves to be capable of reliably responding to a potential future disturbance." Is Witness Holeman's assessment correct?

A. No, it is not. Witness Holeman fundamentally misunderstands my testimony. Witness Holeman is correct that if existing contingency reserves were used to manage solar volatility, the Companies would be exposed to greater risk since those reserves would no longer be available to respond to contingency events. However, this is not what I am recommending. As I explain in my direct testimony, my concern is that upon identifying a reliability shortfall (as measured by the $LOLE_{FLEX}$ metric) the *Ancillary Service Study* calculates the costs of the additional necessary reserves—which are applied 8760 hours a year—based on the assumption that those additional reserves will all be spinning reserves.[22] I recommend that the proposed SISC be discounted based on the fact that far lower-cost fast-start non-spinning reserves could be added instead.

Q. On page 45 of his rebuttal testimony, Witness Holeman states that "the operational parameters that support maintaining contingency reserves off-line is inapplicable to managing the operating reserves needed to manage the growing inter-hour volatility of QF solar on the DEC and DEP Bas." Do you agree that off-line non-spinning reserves are operationally incapable of mitigating solar volatility?

A. No, I do not. Witness Holeman misrepresents the reliability events and the additional reserve requirements identified in the *Ancillary Service Study.* The $LOLE_{FLEX}$ reliability

[22] Direct Testimony of Brendan Kirby at p. 26.

metric imposed a completely unrealistic one-5-minute-imbalance-event-in-ten years reliability limit and the *Ancillary Service Study* itself stated that $LOLE_{FLEX}$ events "rarely occur".[23] Fast-start CTs would not be required to start "several times intra-hour" as Witness Holeman claims in order to meet the *Ancillary Service Study's* added reserve requirements. The rarity of the $LOLE_{FLEX}$ events which drive the *Ancillary Service Study* added solar integration reserve requirements make non-spinning, fast-start reserves appropriate to meet any additional reserve requirements.

Witness Holeman also notes the balancing requirement associated with solar variations is to "ensure the DEC and DEP BAs do not exceed the ACE limits prescribed by NERC for 30 consecutive minutes" (emphasis added) while the "NERC Standard BAL-002 requires that the BA recover to pre-disturbance resource—demand balance levels within 15 minutes from the start of the disturbance (i.e. loss of a large generator)."[24] (emphasis added) In actual operations Duke uses low cost non-spinning reserves to meet its 15-minute contingency balancing requirements but forced the *Ancillary Service Study* to only use high-cost spinning reserves to meet the much slower 30-minute solar and load variability balancing requirement.

Q. Does this conclude your testimony?

A. Yes.

[23] *Ancillary Service Study* at page 11.
[24] Rebuttal Testimony of John Holeman, pages 43-45.